

January 1  
The Big Bang

September 10  
The formation of  
Earth and our solar  
system

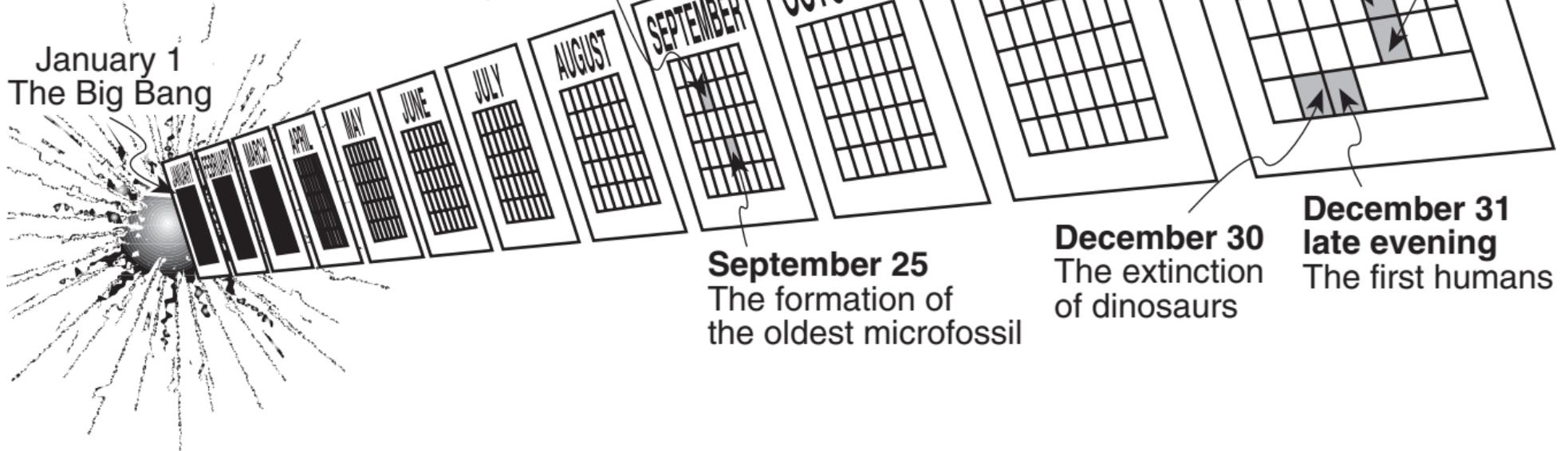
December 19  
The first vertebrates  
(animals with a  
backbone)

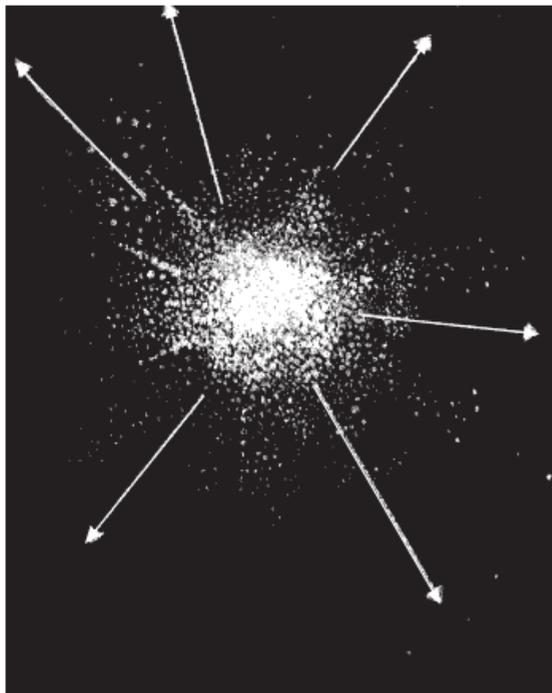
December 26  
Earliest dinosaurs

September 25  
The formation of  
the oldest microfossil

December 30  
The extinction  
of dinosaurs

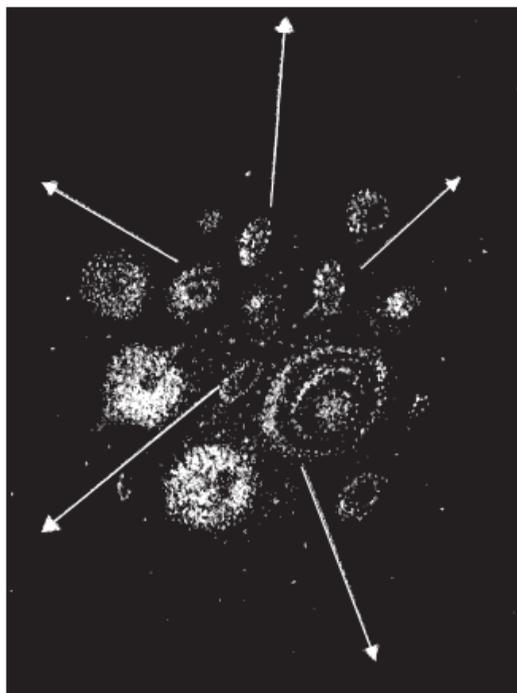
December 31  
late evening  
The first humans





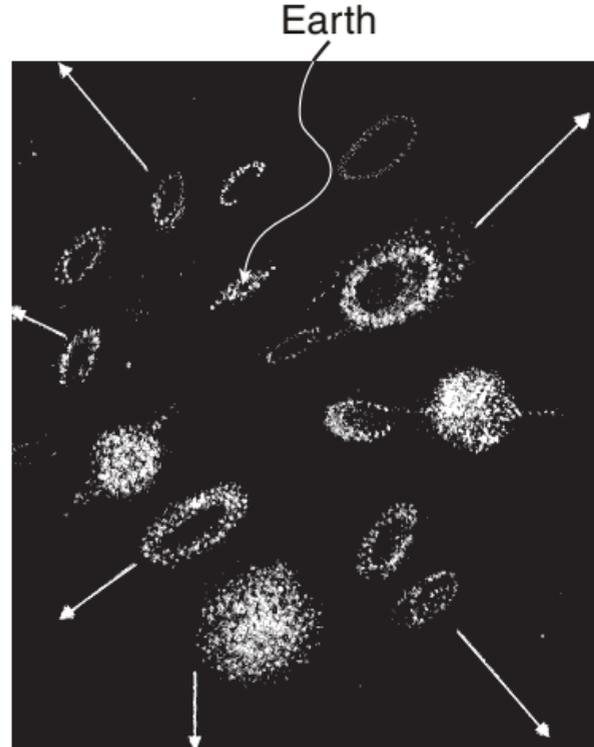
**Stage 1**

A ball of hydrogen exploded.



**Stage 2**

A huge hydrogen cloud moved outward with cloud parts condensing to form galaxies.



**Stage 3 (present)**

The galaxies continue to move outward.

Blue

Red

Laboratory  
spectral lines



Blue

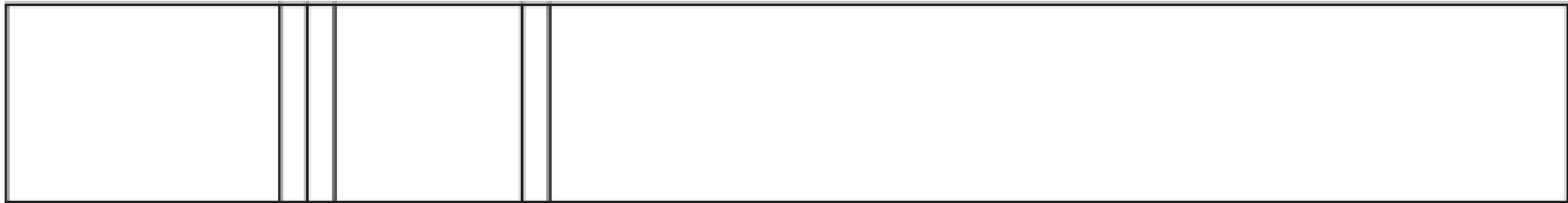
Red

Barnard's Star  
spectral lines

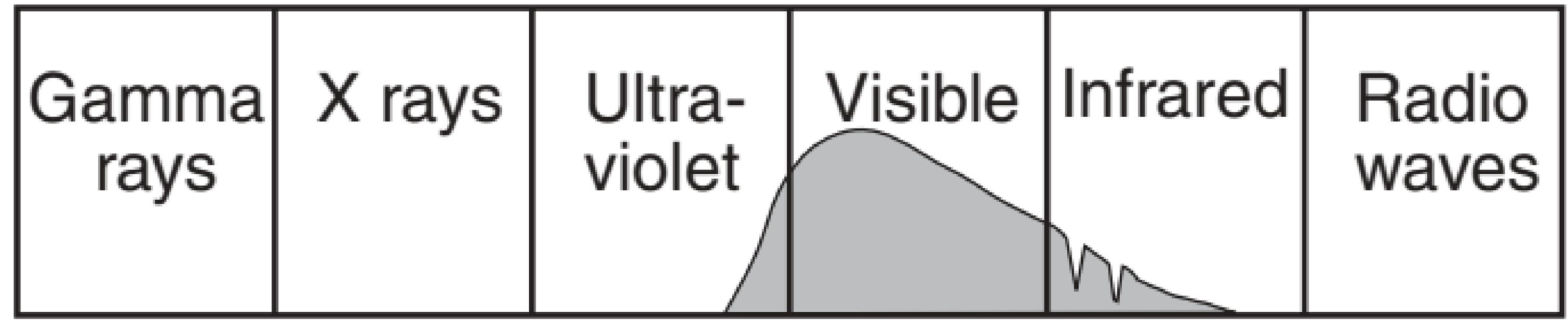
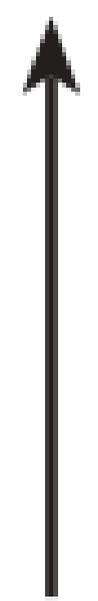


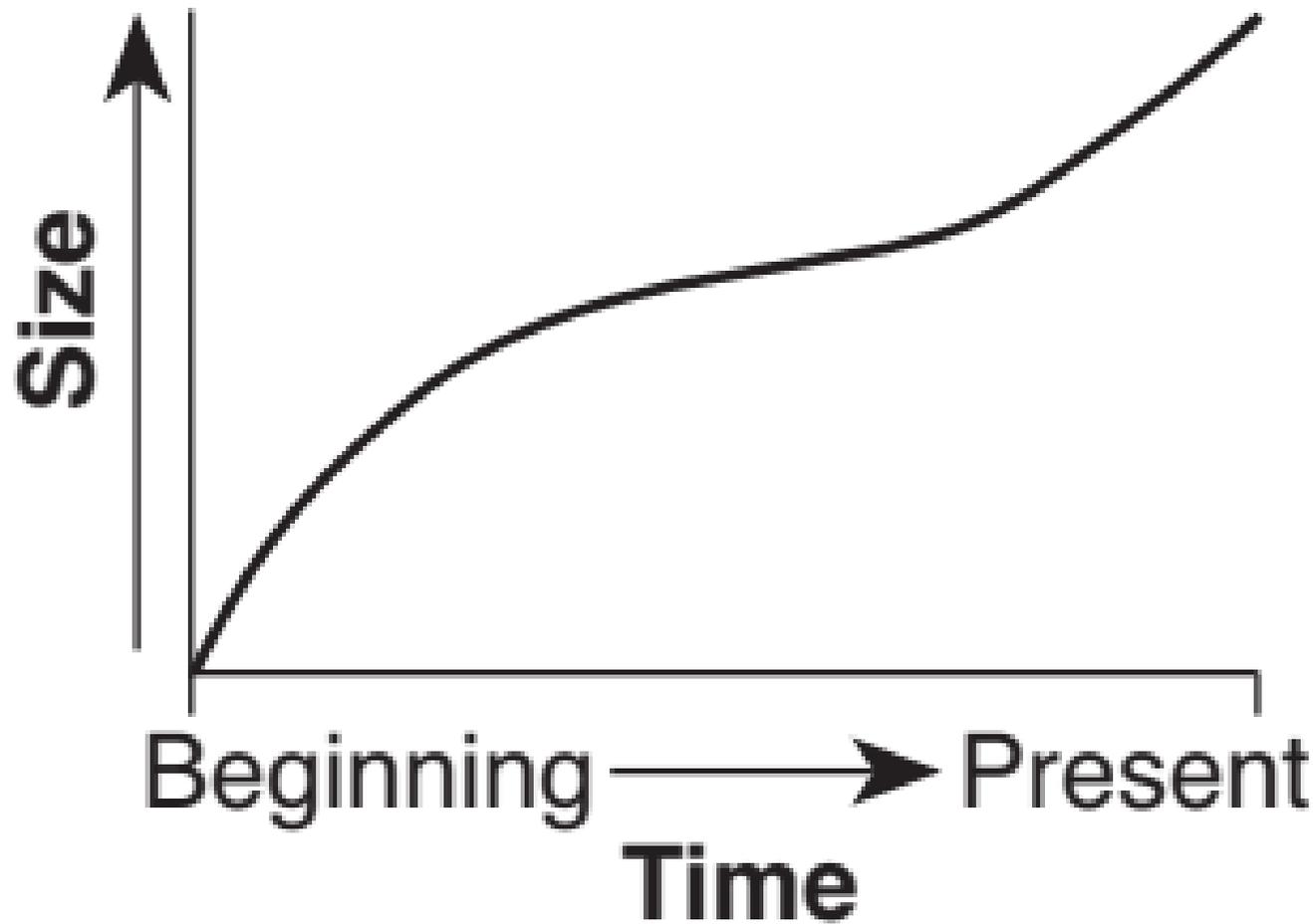
Violet

Red

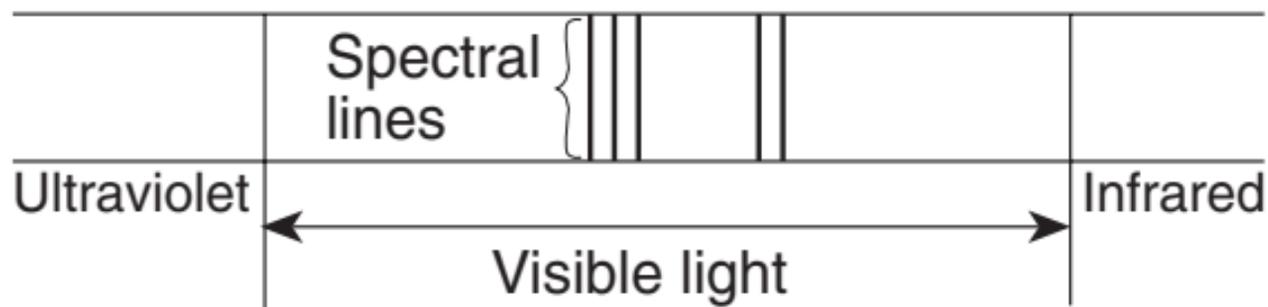


Percentage  
Reaching  
Earth's Surface

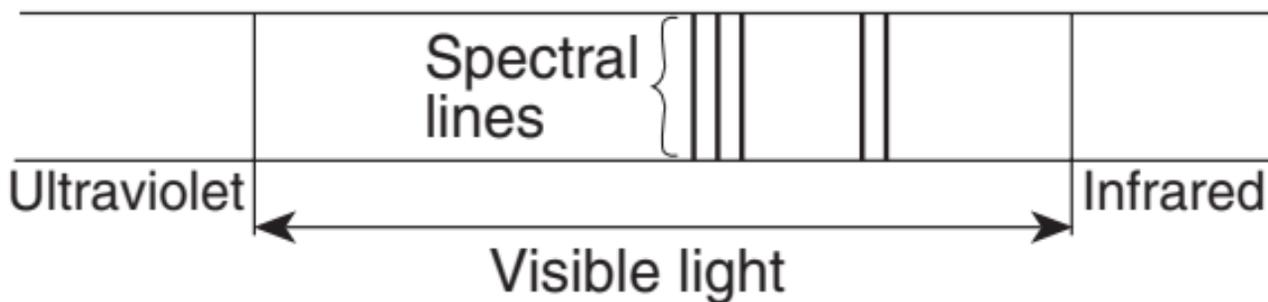


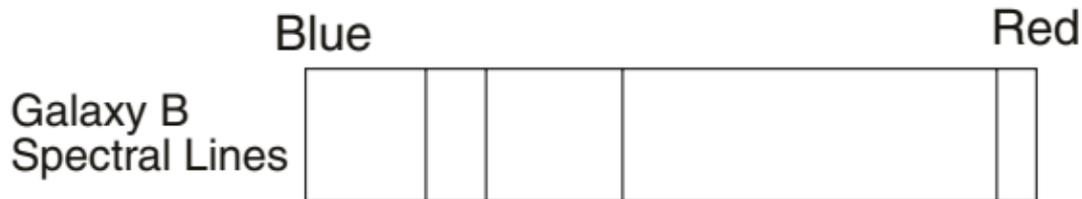
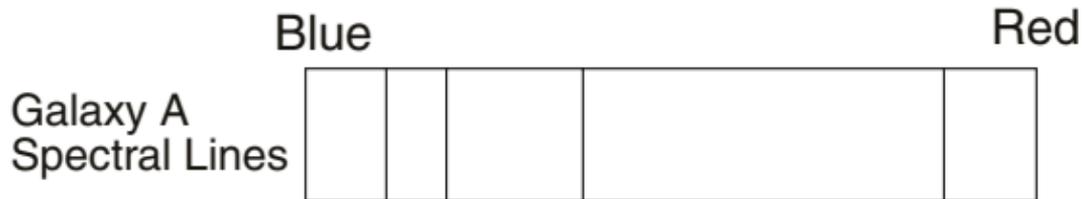


## Standard Spectrum



## Spectrum from Distant Star





Violet

Red



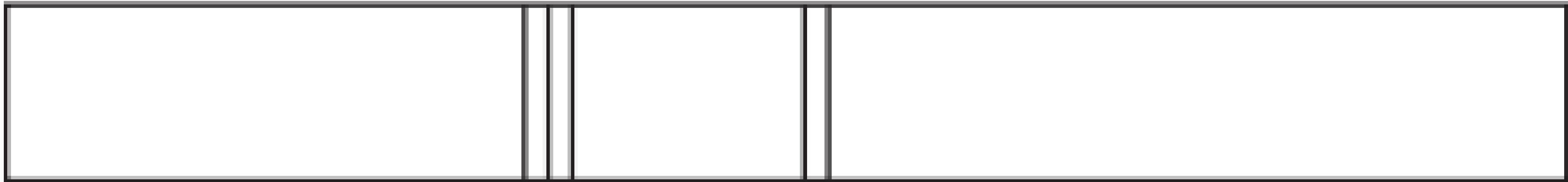
Violet

Red



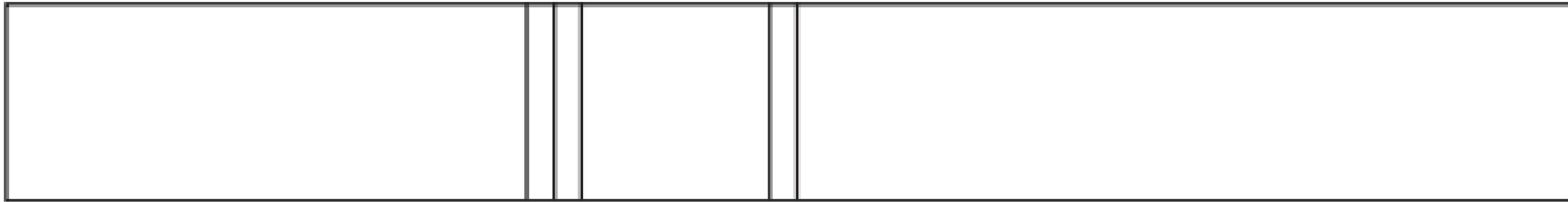
Violet

Red



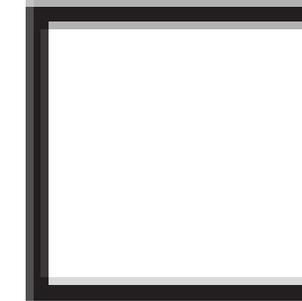
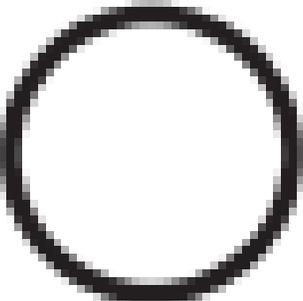
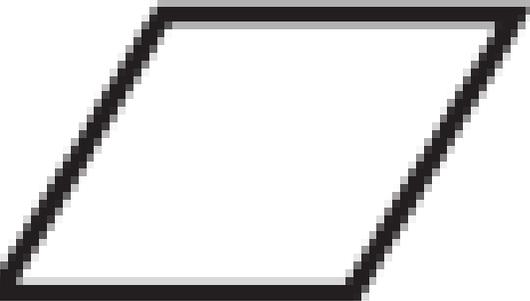
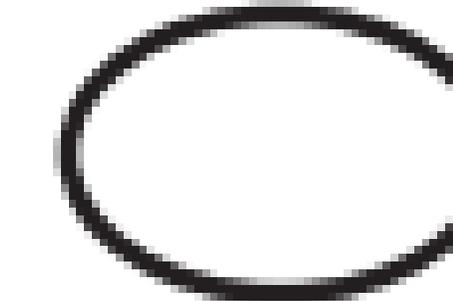
Violet

Red



**Data Table**

<b>Stage</b>	<b>Description of the Universe</b>	<b>Average Temperature of the Universe (°C)</b>	<b>Time From the Beginning of Universe</b>
1	the size of an atom	?	0 second
2	the size of a grapefruit	?	$10^{-43}$ second
3	“hot soup” of electrons	$10^{27}$	$10^{-32}$ second
4	Cooling allows protons and neutrons to form.	$10^{13}$	$10^{-6}$ second
5	still too hot to allow the forming of atoms	$10^8$	3 minutes
6	Electrons combine with protons and neutrons, forming hydrogen and helium atoms. Light emission begins.	10,000	300,000 years
7	Hydrogen and helium form giant clouds (nebulae) that will become galaxies. First stars form.	-200	1 billion years
8	Galaxy clusters form and first stars die. Heavy elements are thrown into space, forming new stars and planets.	-270	13.7 billion years

Universe =  Earth =  Galaxy =  Solar system = 

<b>Name of Galaxy</b>	<b>Distance</b> (million light-years)	<b>Velocity</b> (thousand km/s)
Virgo	70	1.2
Ursa Major 1	900	15
Leo	1100	19
Bootes	2300	40
Hydra	3600	61

One light-year = distance light travels in one year